Buildings Sector Energy Intensity Trends and Projections

Presented to
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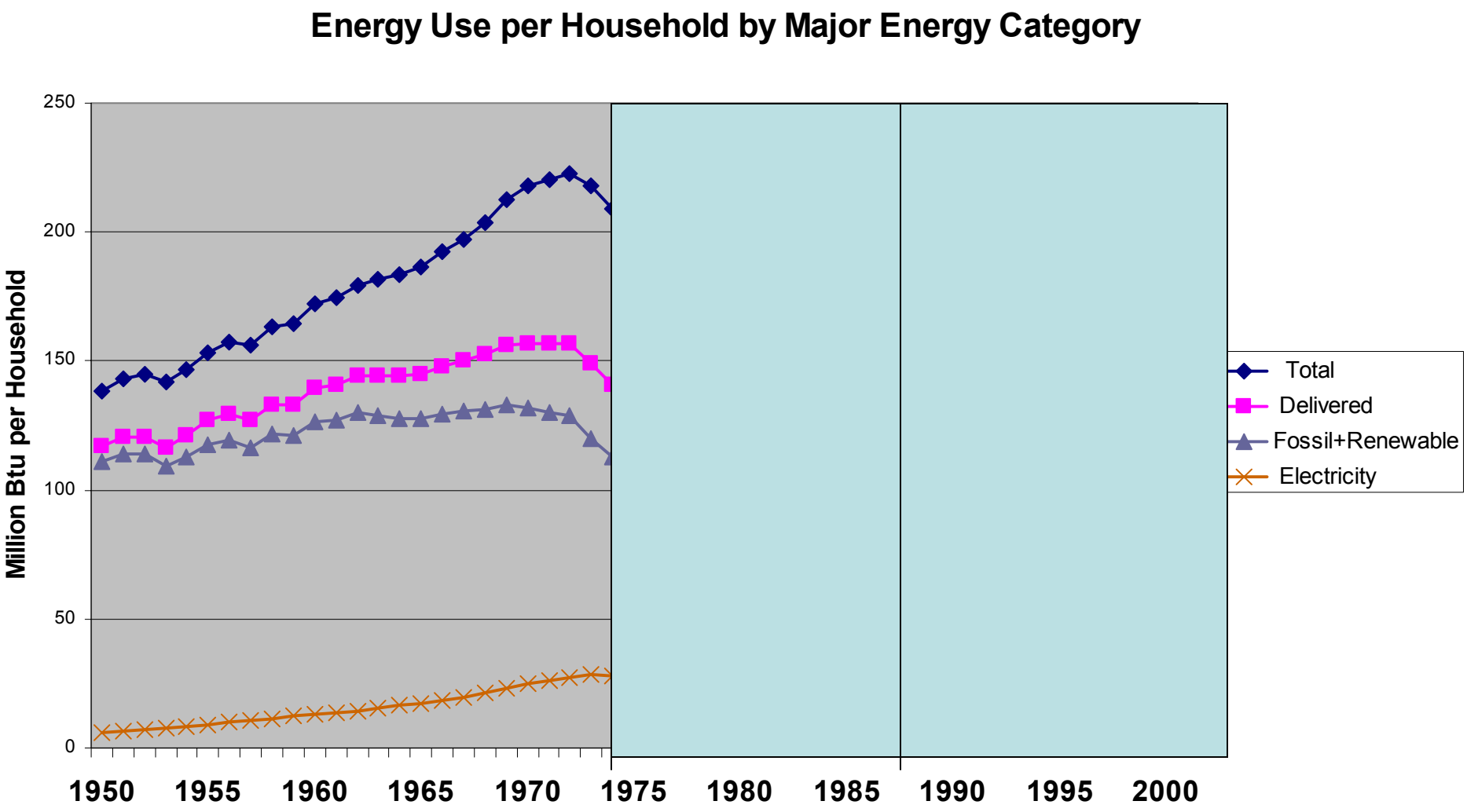
Changes in Residential Energy Intensity Trends over the Past Half Century

Growth rates in energy use per household by sub-period

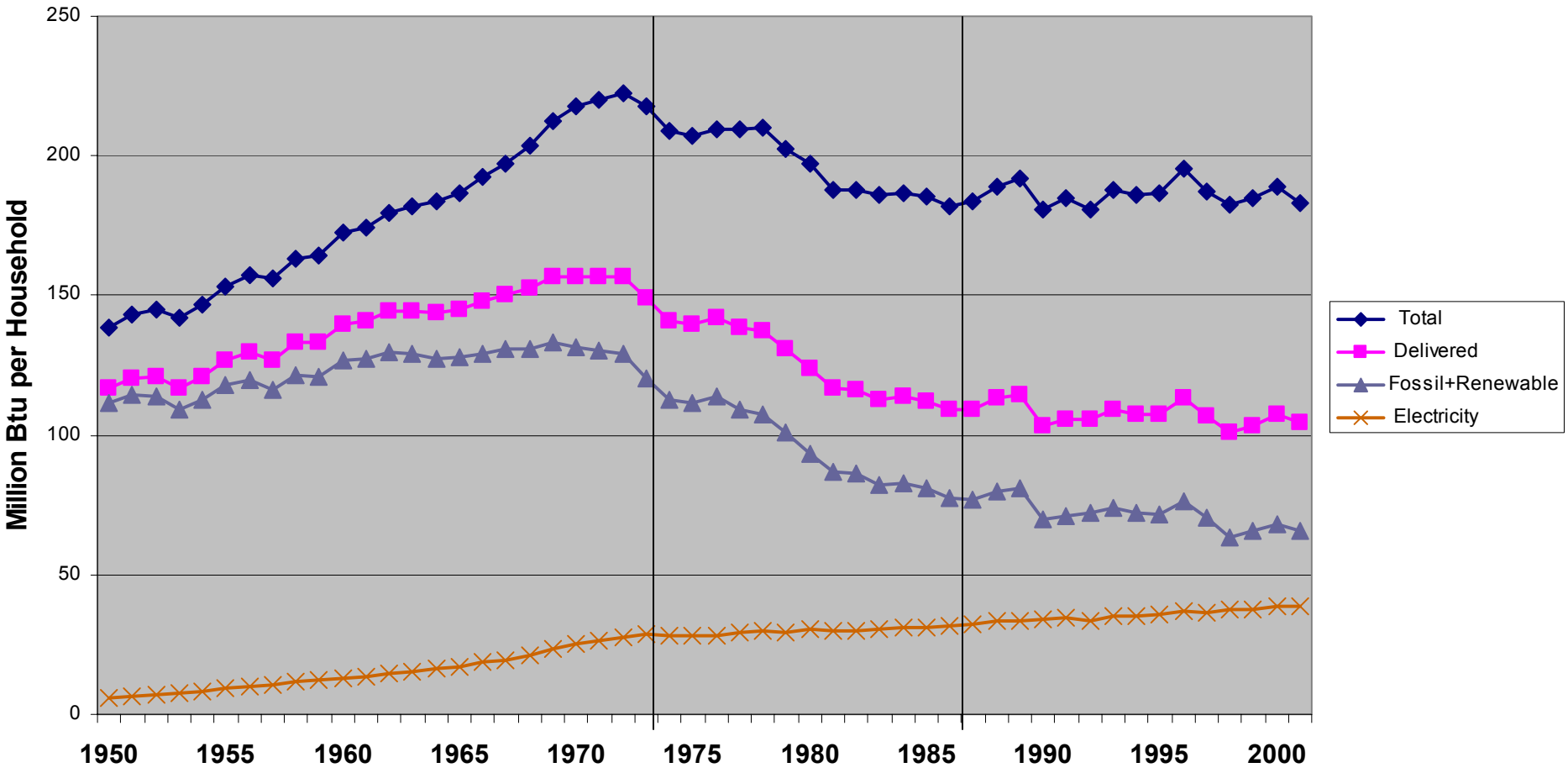
	1950-1973	1973-1986	1986-2001
Delivered	1.0%	-2.2%	-0.3%
Electricity	7.1%	0.7%	1.4%
Fossil + Renewable	0.3%	-3.1%	-1.1%

Fossil fuel use per household has continued to decline, but at a much slower rate than prior to 1986.

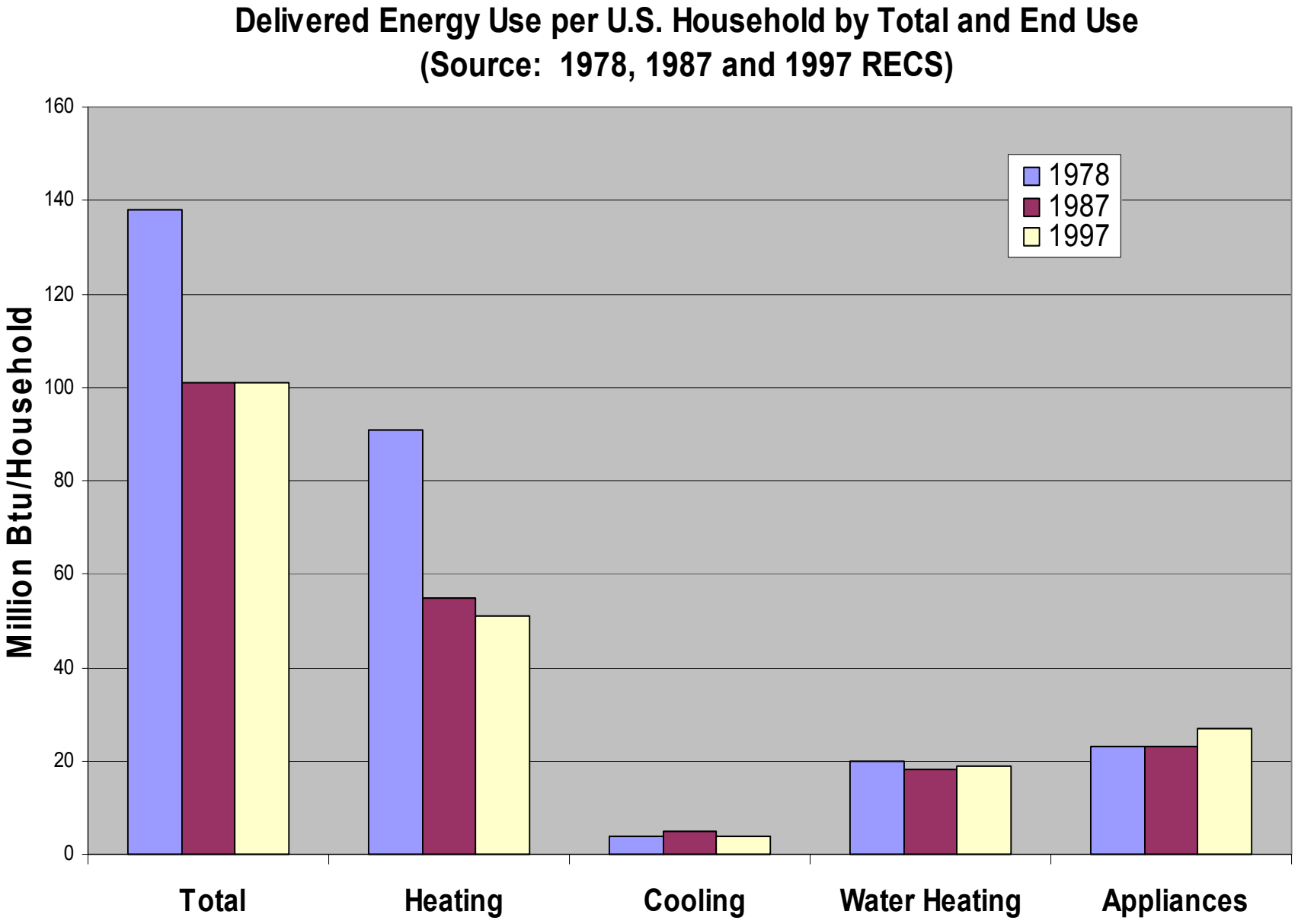
Over past decade and a half, the annual growth rate in electricity use per household has accelerated compared to the 1973-1986 period


Energy Use per Household by Major Energy Category
Million Btu per Household
250
200
150
100
50
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
Total
Delivered
Fossil+Renewable
Electricity

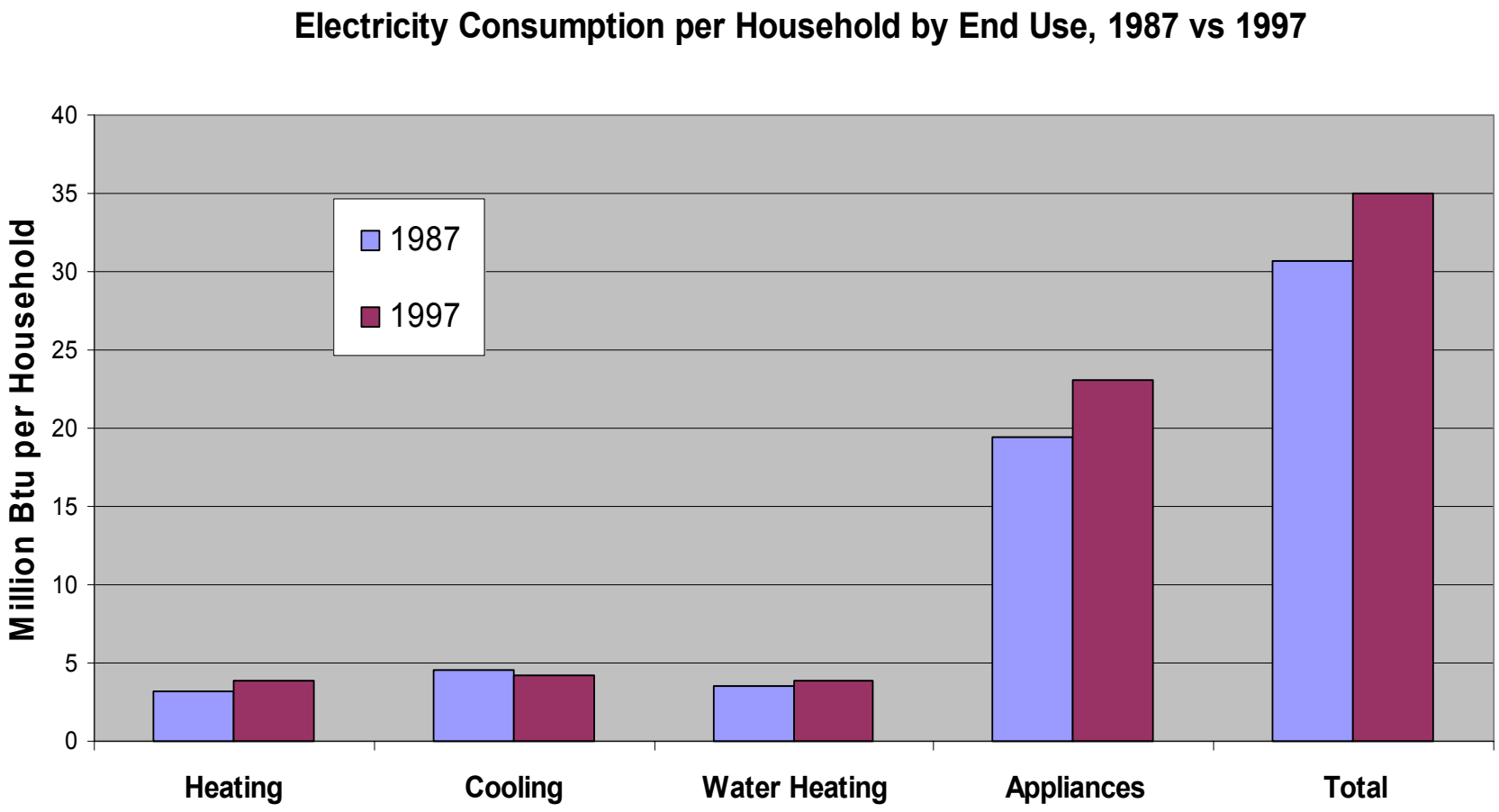
Energy Use per Household by Major Energy Category



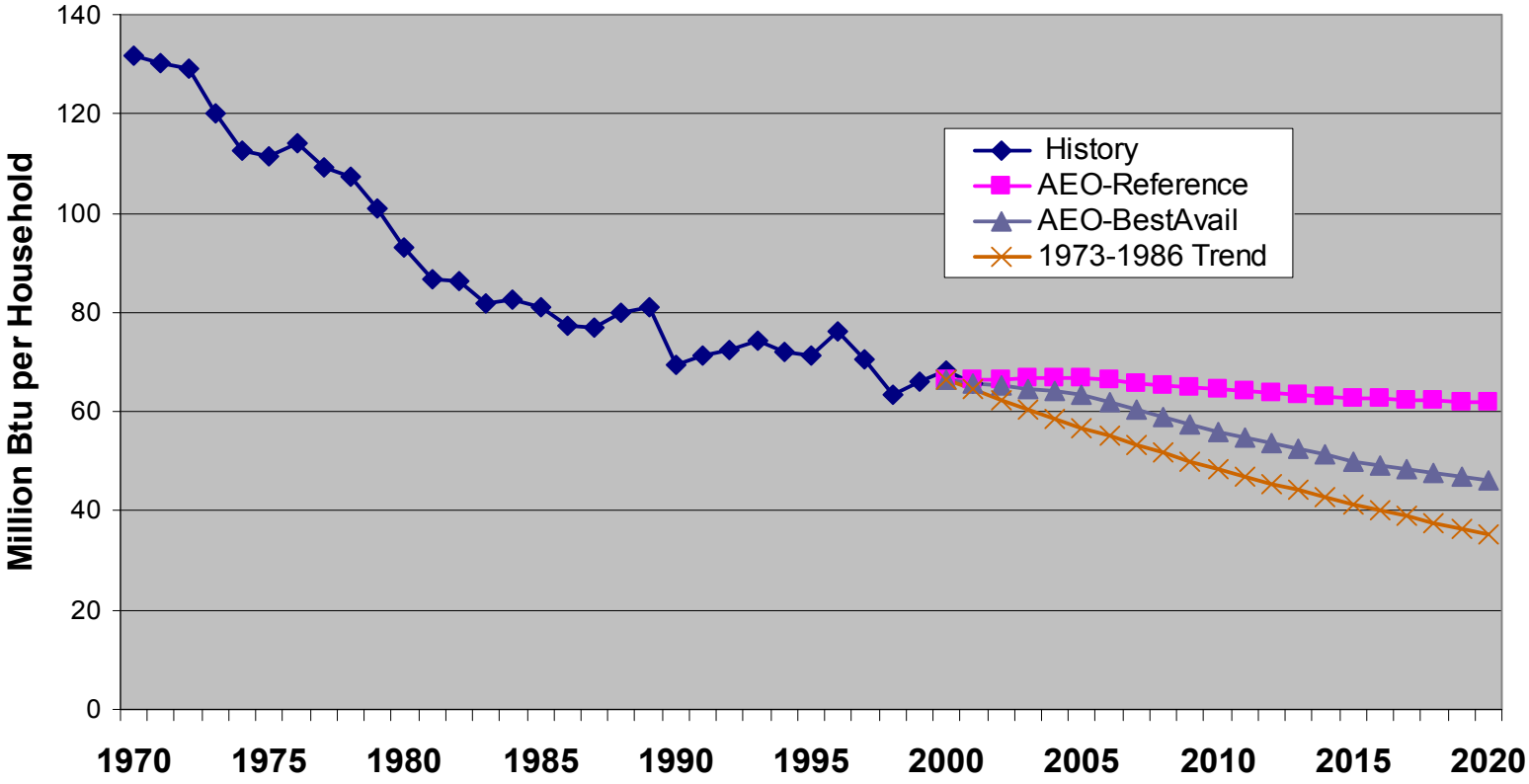
Space heating accounts for nearly all the reduction in energy use per household since 1978—appliance use has increased sharply in the 90s



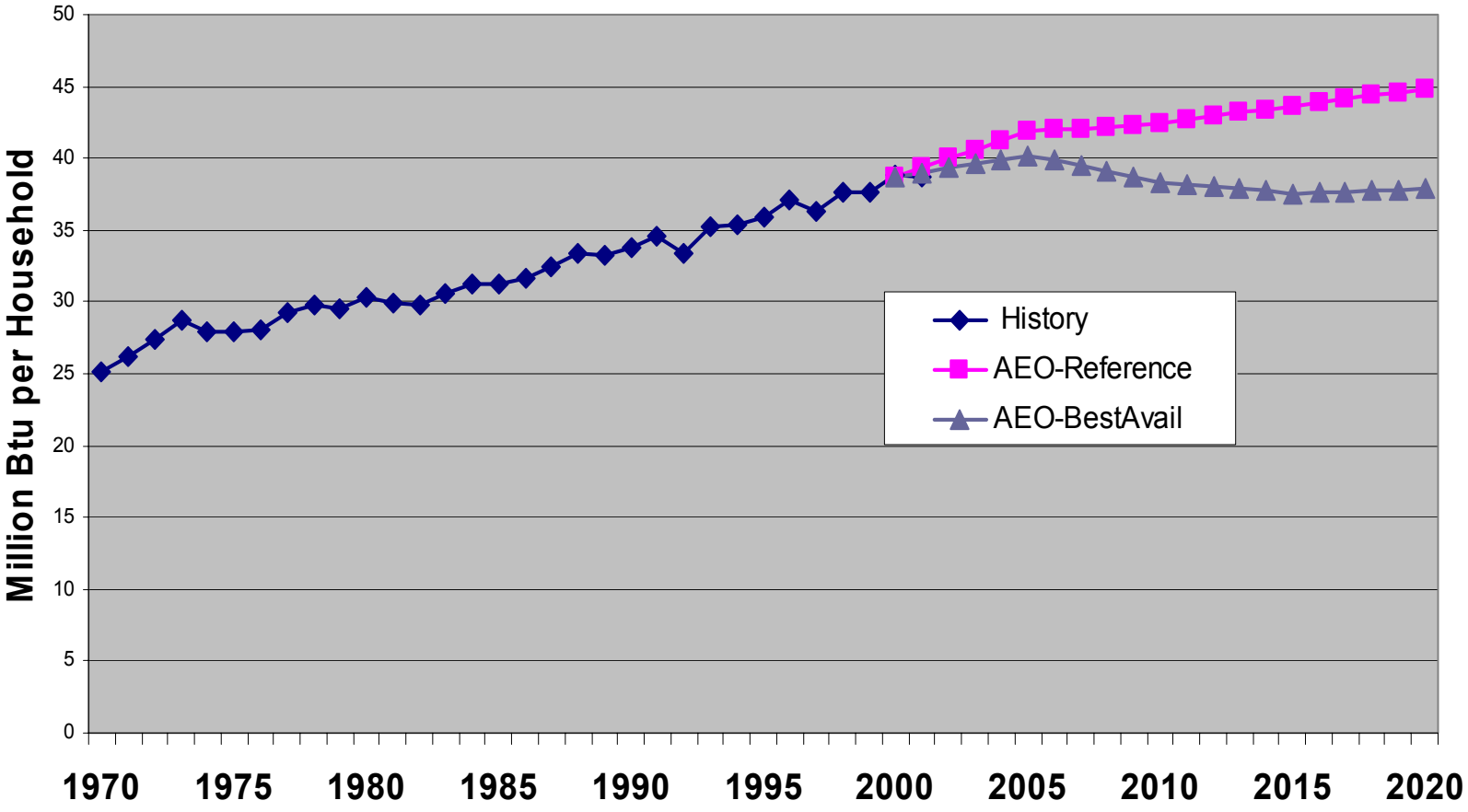
Most of increase from 1987 to 1997 was due to increased use of appliances and lighting



Projections of Fossil/Renewable Fuel Consumption per Household



Projections of Electricity Consumption per Household



Changes in Commercial Energy Intensity Trends over the Past Half Century

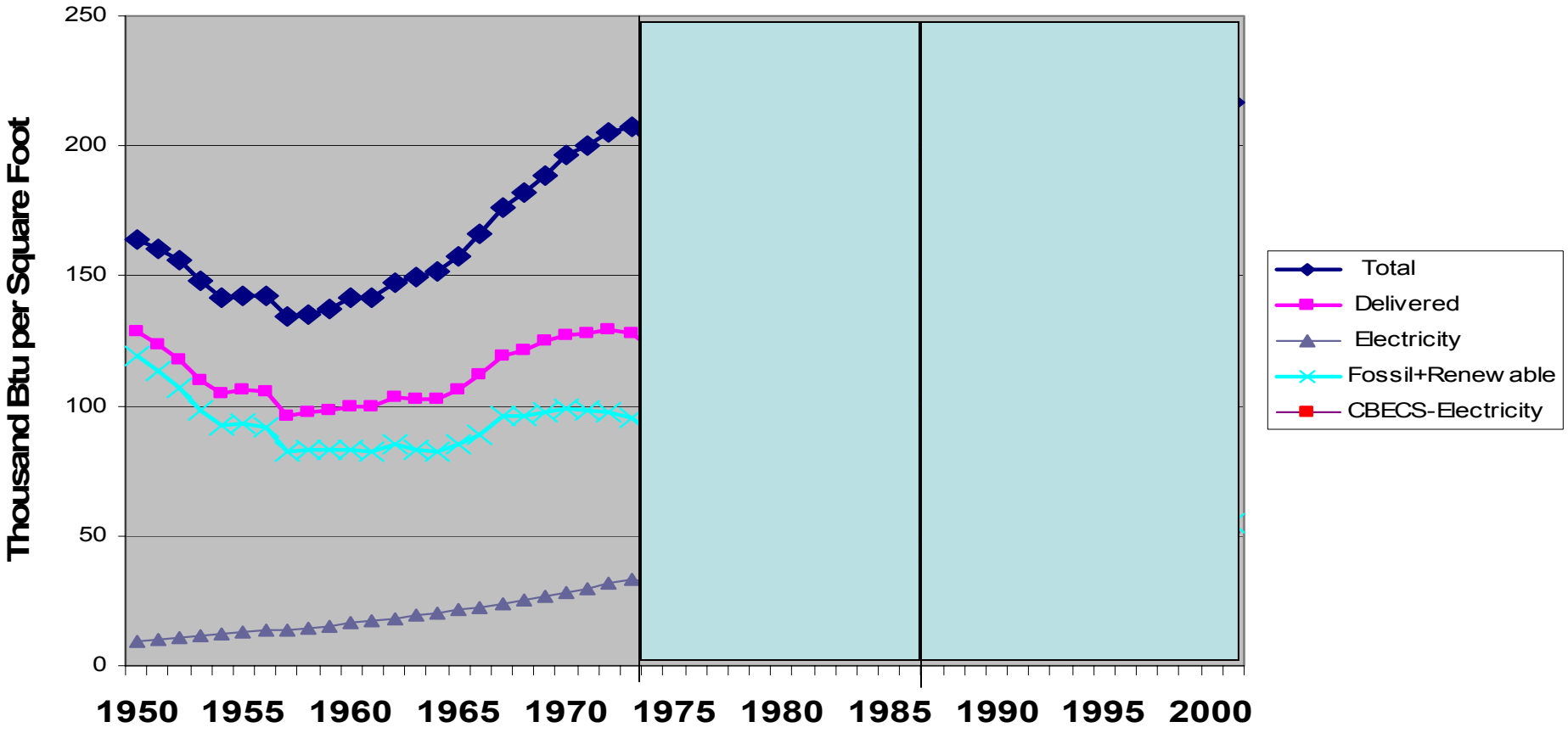
Growth rates in energy use per square foot by sub-period

	1950-1973	1973-1986	1986-2001
Delivered	0.0%	-1.6%	-0.8%
Electricity	5.4%	1.6%	1.8%
Fossil + Renewable	-0.7%	-3.2%	-0.7%

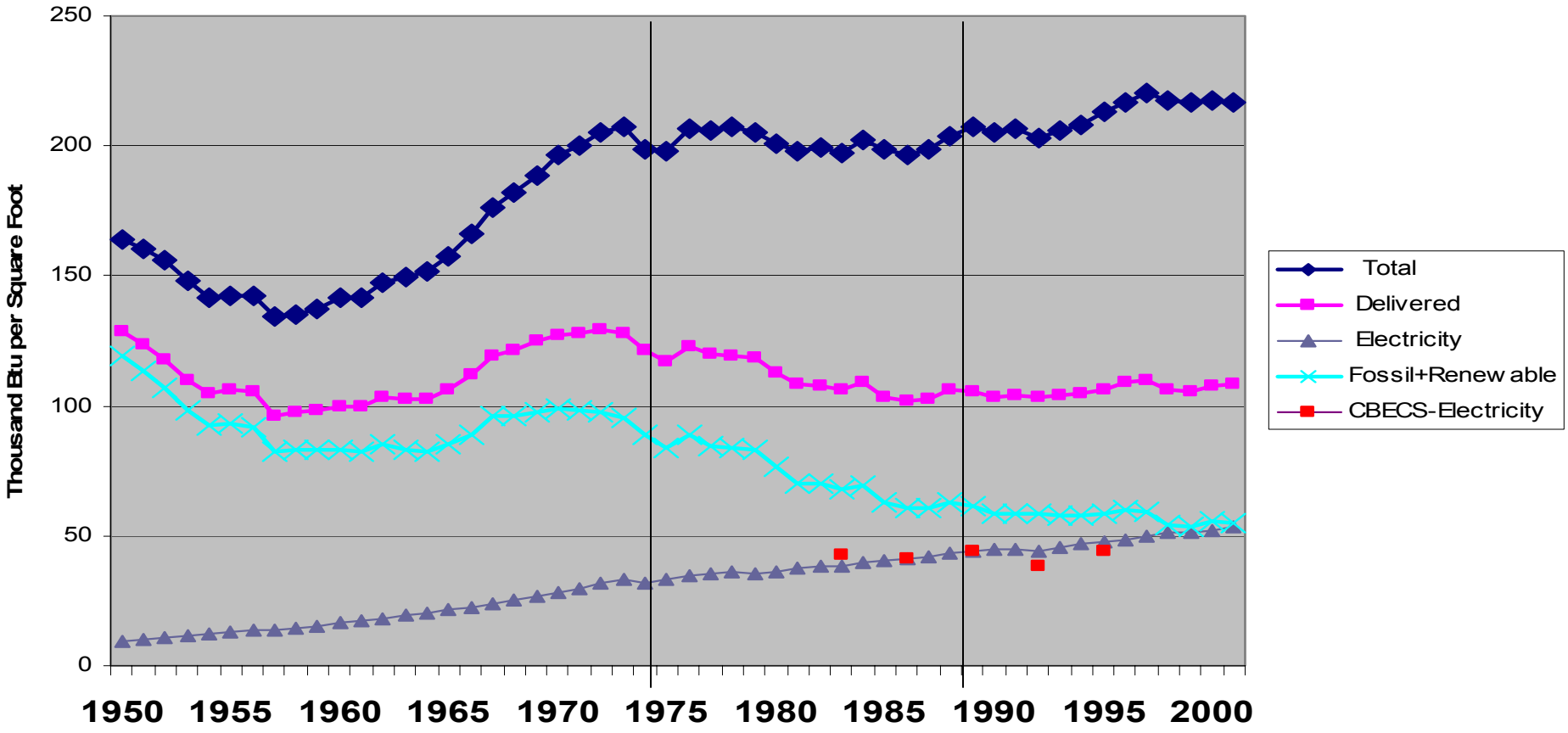
The decline in fossil fuel intensity since the mid-1980s has been very small

Over past decade and a half, the *growth* rate of electricity use per square foot has changed little from the 1973-1986 period.

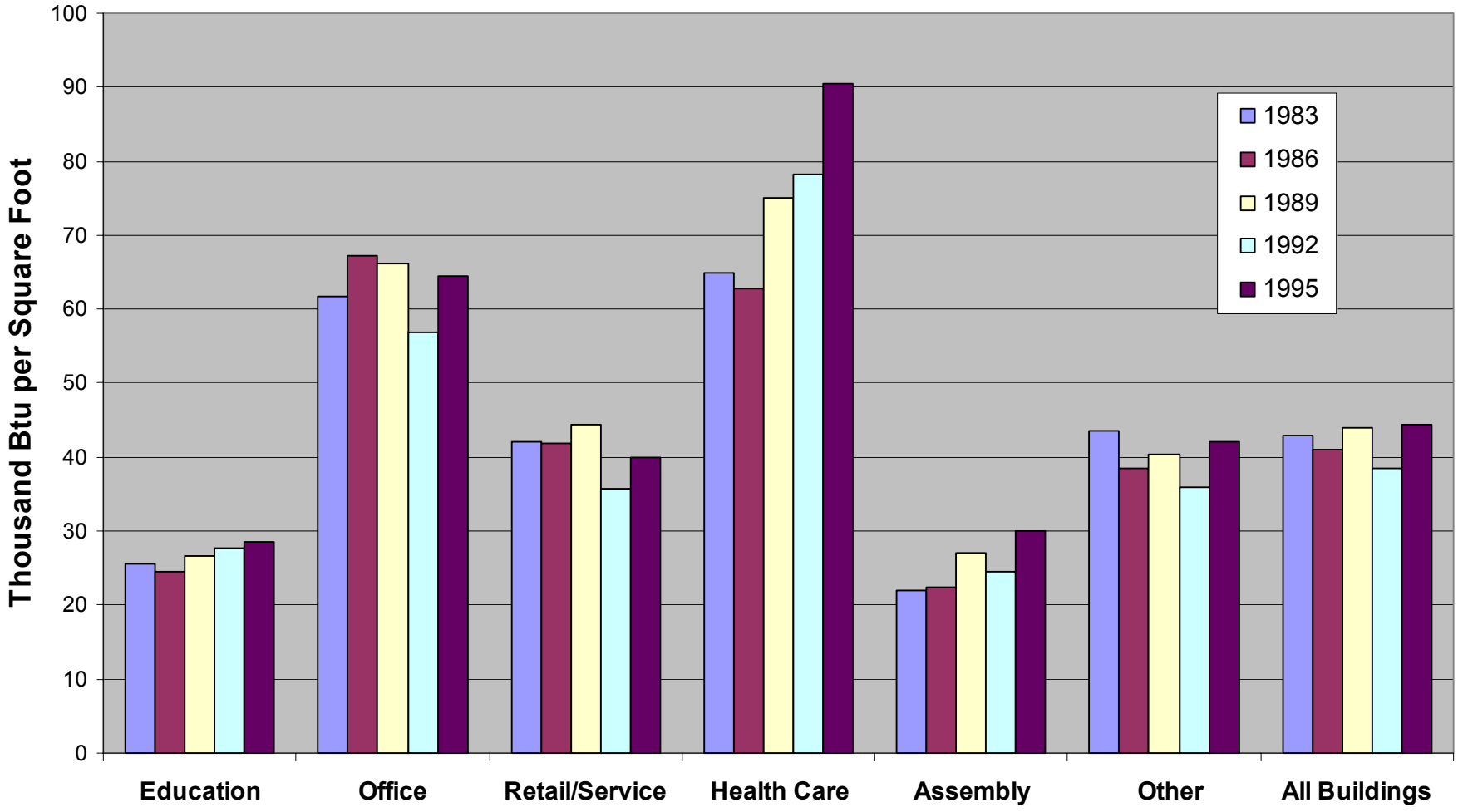
Energy Use per Square Foot by Major Energy Category
Commercial Sector



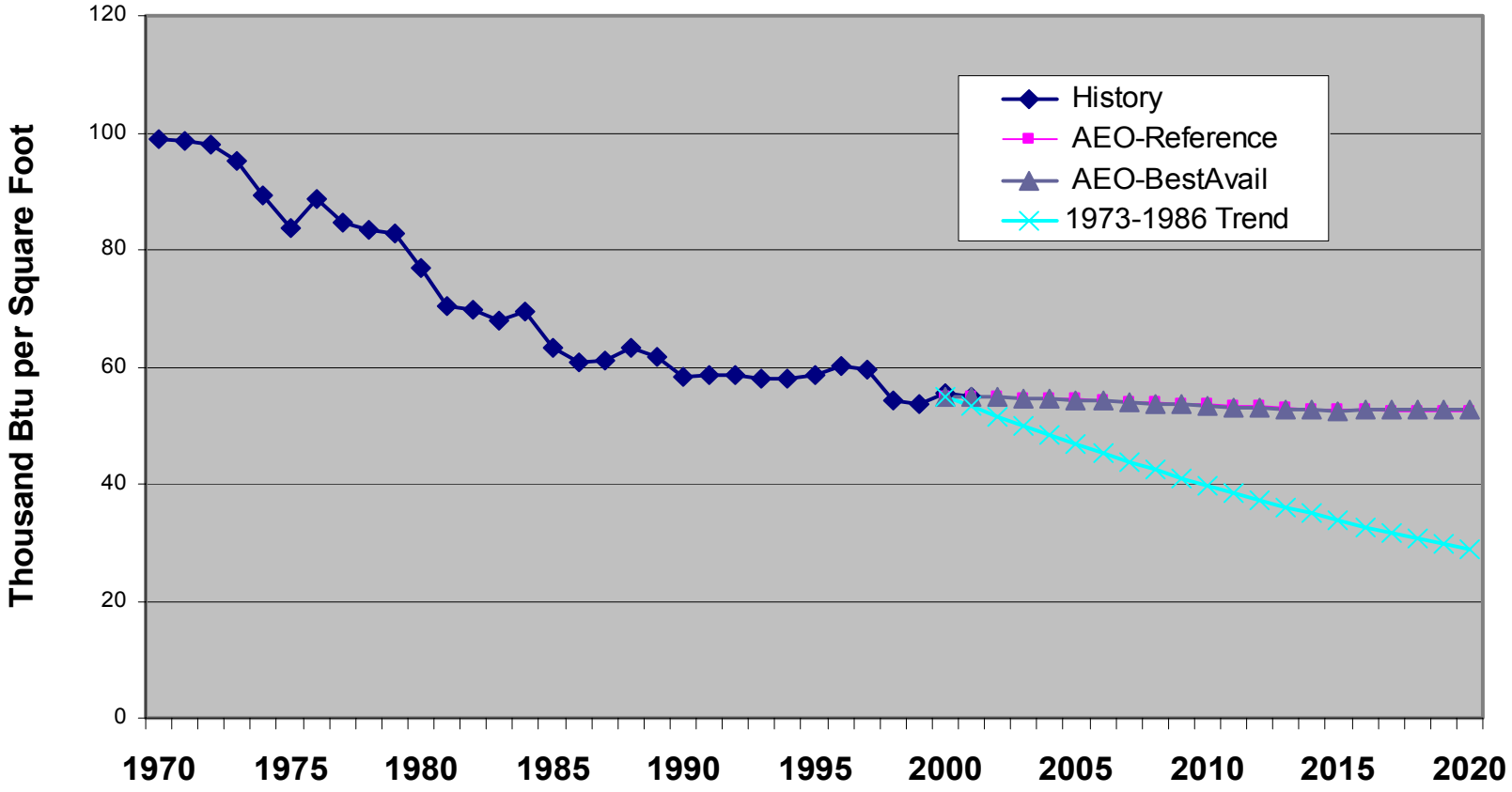
Energy Use per Square Foot by Major Energy Category
Commercial Sector



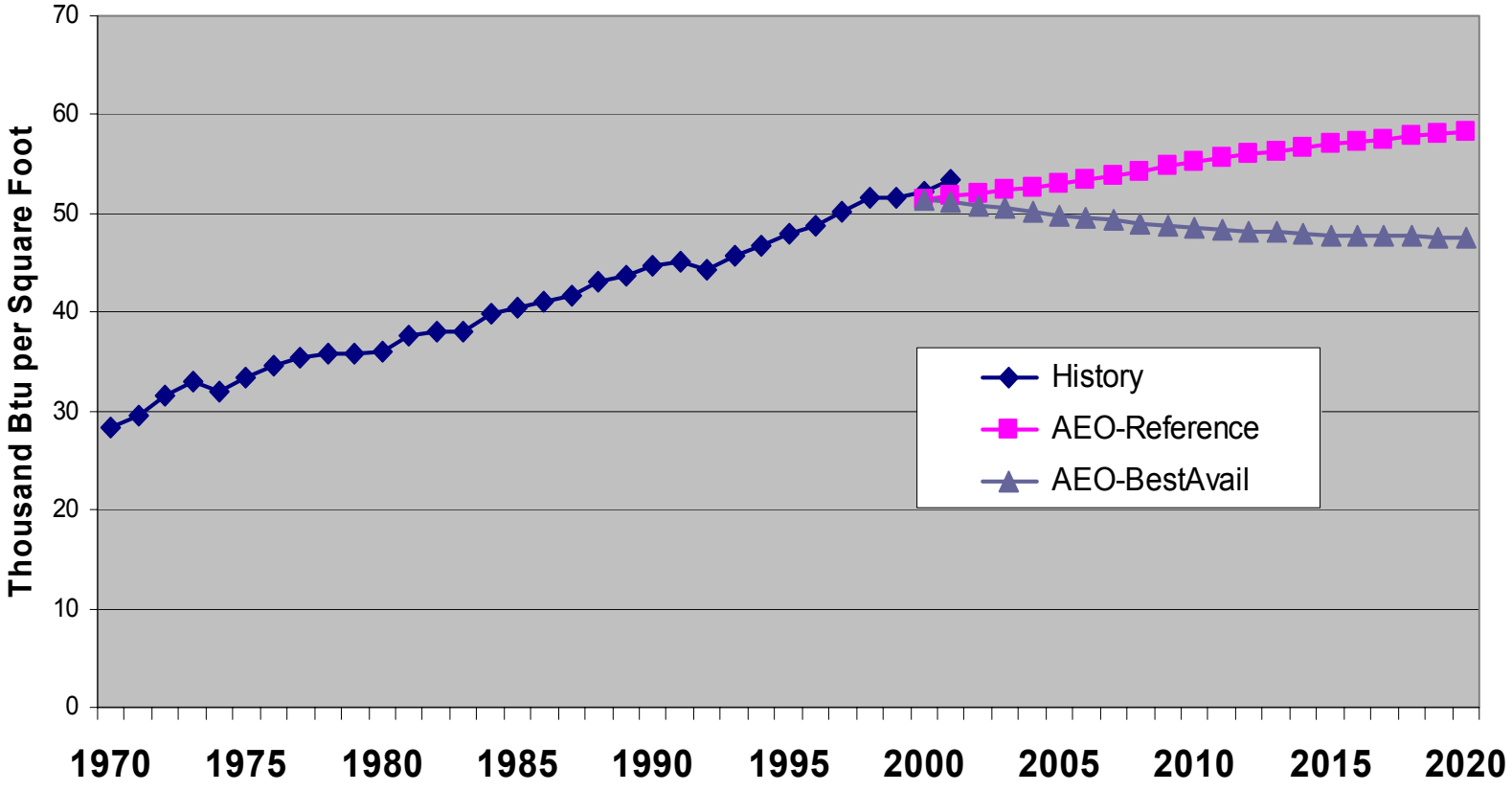
Electricity Consumption per Square Foot by Building Type
Source: 1983 through 1995 CBECS



Projections of Fossil Fuel Consumption per Square Foot
Commercial Sector



Projections of Electricity Consumption per Square Foot
Commercial Sector



To Summarize – What Do the Trends Tell Us?

- Heating intensities (reflected primarily in fossil fuel use) declined significantly since the 1970s, but have fallen more slowly since the mid-1980s.
- Defined in this broad manner (per household, per square foot), increases in electricity intensity have continued unabated during the 1990s. (For commercial buildings, some data issues are unresolved.) More appliances/equipment have swamped efficiency improvements for specific devices.
- Over the long term, looking at different sub-periods, energy prices appear to be an important influence on energy intensity

Some Implications

- Heating with fossil fuels remains the single largest end use in the buildings sector, and so it still presents significant opportunity
  - Further improvement of conventional equipment faces combustion efficiency limits, but sensor technology could ensure optimal operation
  - Significant improvement in new buildings is possible – with new integrated systems (e.g. BCHP, space/water heat systems), advanced building envelopes, and more efficient duct systems.
  - Trends toward reduced fuel intensities in existing buildings will likely not change much, unless significant incentives are present
- Efforts to reduce the growth in electricity intensity will be challenging
  - Research need is to better understand the new types of electricity-using equipment (e.g., internet, small home appliances, office equipment)
  - For commercial buildings, new technologies to reduce lighting and cooling can offset growth in other uses (solid state lighting, electrochromic windows, improved HVAC diagnostic systems)